

## Preface

The Internet extends the power of the personal computer (PC) from being a personal machine to one that is connected to the world. Instead of being able to carry out just some simple gaming, data, and word-processing tasks, a PC using the Internet has access to an increasingly large variety of applications offered by numerous Web sites and application providers. Applications such as purchasing, banking, library access, entertainment download, and tax returns can now be routinely carried out by a low-cost PC with an Internet connection at any time from practically anywhere.

Most of the current applications however are software-oriented in nature and do not involve access to physical hardware or equipment on the server side or remote site. In terms of evolution, this is perhaps not unexpected as it is always easier for programs (software), which are more flexible, to evolve first. From this angle, future development of the Internet may include many more applications where hardware can be controlled or different pieces of hardware can communicate with each other to enable us to have a better working and living environment.

This book is on an application in this direction and involves the creation of Internet remote experimentation for the purpose of education. The design and setup of an Internet system that can control and monitor physical equipment and activities at a remote site is a task that is inherently more difficult than setting up a software-based Web site. Specifically, not only does the Web browser on the user side have to talk to the server on the remote site, but the remote site must also communicate with a variety of instruments under its control and audio/video feedback must be streamed back to the user.

The topics covered in this book are based on the research and development work that we have carried out in designing and implementing a number of Web-based experiments to enhance the learning experience of our students in the Department of Electrical and Computer Engineering at the National University of Singapore. While the book gives examples on Web-based experimentation, it will also suit those who would like to create Internet systems that interact with hardware equipment for purposes such as security, research collaboration, home and office automation, robotics, and so on. The overall design and some of the source code

included may be modified or reused to save development time. Furthermore, it can serve as a useful reference for Web site designers, programmers, and administrators.

The book consists basically of two sections. The first section, involving most of the chapters, presents the design and main hardware and software components of the system in a generic manner. The second section, including the last chapter and the appendices, gives a complete implementation example. By illustrating how the various components are integrated together to form a working system, this section may be most useful to programmers, engineers, and researchers.

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